

CLAIMS

1. A laminated glass,
wherein at least an interlayer film for laminated
5 glasses and a glass sheet are laminated and unified, Head
Injury Criteria (HIC) values, measured according to
regulations of European Enhanced Vehicle-safety Committee;
EEVC/WG 17, being 1,000 or lower.
- 10 2. A laminated glass,
wherein at least an interlayer film for laminated
glasses and a glass sheet are laminated and unified, Head
Injury Criteria (HIC) values, measured by dropping an
15 impactor head from a height of 4 m above the surface of the
laminated glass according to regulations of Economic
Commission for Europe; ECE-Regulation No. 43 Annex 3, being
300 or lower.
- 20 3. The laminated glass according to Claim 1 or 2,
wherein the interlayer film for laminated glasses
contains a plasticizer for interlayer films in an amount 30
parts by weight or more per 100 parts by weight of
polyvinyl acetal resin.
- 25 4. The laminated glass according to Claim 1, 2 or 3,
wherein the interlayer film for laminated glasses has
a storage elasticity modulus G' in a linear dynamic
viscoelasticity test, measured with frequencies being
varied at 20°C in a range of frequencies of 5.0×10^1 to
30 1.0×10^2 Hz, of 3×10^7 Pa or lower.
5. The laminated glass according to Claim 1, 2, 3 or
4,
wherein the interlayer film for laminated glasses has
35 $\tan \delta$ of at least one point of 0.6 or more at 20°C in a

range of frequencies of 5.0×10^1 to 1.0×10^2 Hz.

6. The laminated glass according to Claim 1, 2, 3, 4 or 5,

5 wherein the interlayer film for laminated glasses has maximum stress σ of 20 MPa or lower and fracture point deformation ϵ of 200% or more, derived from a stress-deformation curve at 20°C and a tensile speed of 500%/min.

10 7. The laminated glass according to Claim 6, wherein the interlayer film for laminated glasses has breaking energy of 1.0 J/mm^2 or larger.

15 8. The laminated glass according to Claim 4, 5, 6 or 7,

wherein the interlayer film for laminated glasses comprises a crosslinked polyvinyl acetal resin having an acetalization degree of 60 to 85 mol% and contains a plasticizer for interlayer films in an amount 40 parts by weight or more per 100 parts by weight of the above-mentioned polyvinyl acetal resin.

25 9. The laminated glass according to Claim 8, wherein the interlayer film for laminated glasses has a thickness of 800 μm or more.

10. The laminated glass according to Claim 4, 5, 6, 7, 8 or 9,

30 wherein the interlayer film for laminated glasses comprises a polyvinyl acetal resin having a half band width of a peak of a hydroxyl group of 250 cm^{-1} or lower in measuring infrared absorption spectra.

35 11. The laminated glass according to Claim 4, 5, 6, 7, 8, 9 or 10,

wherein rubber particles are dispersed in the interlayer film for laminated glasses.

12. The laminated glass according to Claim 1, 2, 3,
5 4, 5, 6, 7, 8, 9, 10 or 11,

wherein the interlayer film for laminated glasses has a multilayer structure.

13. The laminated glass according to Claim 12,
10 wherein the interlayer film for laminated glasses has a two-layers structure and a storage elasticity modulus G' at 20°C and a frequency of 5.0×10^1 to 1.0×10^2 Hz in one layer is at or below a half of a storage elasticity modulus G' at 20°C and a frequency of 5.0×10^1 to 1.0×10^2 Hz in
15 the other layer.

14. The laminated glass according to Claim 13,
wherein the storage elasticity modulus G' at 20°C and a frequency of 5.0×10^1 to 1.0×10^2 Hz in one layer is 2×10^6 Pa or lower and the storage elasticity modulus G' at
20 20°C and a frequency of 5.0×10^1 to 1.0×10^2 Hz in the other layer is 1×10^7 Pa or higher.

15. The laminated glass according to Claim 14,
25 wherein the layer having a storage elasticity modulus G' of 2×10^6 Pa or lower at 20°C and a frequency of 5.0×10^1 to 1.0×10^2 Hz has $\tan \delta$ of 0.7 or more at 20°C and a frequency of 5.0×10^1 to 1.0×10^2 Hz.

16. The laminated glass according to Claim 12,
30 wherein the interlayer film for laminated glasses has a three-layers structure and a storage elasticity modulus G' at 20°C and a frequency of 5.0×10^1 to 1.0×10^2 Hz in an intermediate layer is at or below a half of a storage
35 elasticity modulus G' at 20°C and a frequency of 5.0×10^1

to 1.0×10^2 Hz in one or any of two layers composing the outermost layer.

17. The laminated glass according to Claim 16,
5 wherein a storage elasticity modulus G' at 20°C and a frequency of 5.0×10^1 to 1.0×10^2 Hz in the intermediate layer is 2×10^6 Pa or lower and a storage elasticity modulus G' at 20°C and a frequency of 5.0×10^1 to 1.0×10^2 Hz in one or any of two layers composing the outermost
10 layer is 1×10^7 Pa or higher.

18. The laminated glass according to Claim 17,
wherein the intermediate layer has $\tan \delta$ of 0.7 or more at 20°C and a frequency of 5.0×10^1 to 1.0×10^2 Hz.
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19. The laminated glass according to Claim 16, 17 or 18,
wherein a thickness of the intermediate layer is 10% or higher of a total thickness of the interlayer film for
20 laminated glasses.

20. The laminated glass according to Claim 12,
wherein the interlayer film for laminated glasses has a three-layers structure and a storage elasticity modulus
25 G' at 20°C and a frequency of 5.0×10^1 to 1.0×10^2 Hz in one or any of two layers composing the outermost layer is at or below a half of a storage elasticity modulus G' at 20°C and a frequency of 5.0×10^1 to 1.0×10^2 Hz in an intermediate layer.
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21. The laminated glass according to Claim 20,
wherein a storage elasticity modulus G' at 20°C and a frequency of 5.0×10^1 to 1.0×10^2 Hz in one or any of two layers composing the outermost layer is 2×10^6 Pa or lower
35 and a storage elasticity modulus G' at 20°C and a frequency

of 5.0×10^1 to 1.0×10^2 Hz in the intermediate layer is 1×10^7 Pa or higher.

22. The laminated glass according to Claim 21,
5 wherein $\tan \delta$ at 20°C and a frequency of 5.0×10^1 to 1.0×10^2 Hz in one or any of two layers composing the outermost layer is 0.7 or more.

23. The laminated glass according to Claim 20, 21 or
10 22,
wherein a total thickness of the outermost layer is 10% or higher of a total thickness of the interlayer film for laminated glasses.

24. The laminated glass according to Claim 12,
15 wherein the interlayer film for laminated glasses has a multilayer structure of four-layers or more and a storage elasticity modulus G' at 20°C and a frequency of 5.0×10^1 to 1.0×10^2 Hz in at least one layer of an intermediate
20 layer is at or below a half of a storage elasticity modulus G' at 20°C and a frequency of 5.0×10^1 to 1.0×10^2 Hz in one or any of two layers composing the outermost layer.

25. The laminated glass according to Claim 24,
25 wherein a storage elasticity modulus G' at 20°C and a frequency of 5.0×10^1 to 1.0×10^2 Hz in at least one layer of the intermediate layer is 2×10^6 Pa or lower and a storage elasticity modulus G' at 20°C and a frequency of 5.0×10^1 to 1.0×10^2 Hz in one or any of two layers
30 composing the outermost layer is 1×10^7 Pa or higher.

26. The laminated glass according to Claim 25,
wherein the intermediate layer having a storage elasticity modulus G' of 5.0×10^1 to 1.0×10^2 Hz being 2×10^6 Pa or lower at 20°C and a frequency has $\tan \delta$ of 0.7
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or more at 20°C and a frequency of 5.0×10^1 to 1.0×10^2 Hz.

27. The laminated glass according to Claim 25 or 26,
wherein a total thickness of the intermediate layer
5 having a storage elasticity modulus G' of 2×10^6 Pa or
lower at 20°C and a frequency of 5.0×10^1 to 1.0×10^2 Hz
is 10% or higher of a total thickness of the interlayer
film for laminated glasses.

10 28. The laminated glass according to Claim 17, 18,
19, 25, 26 or 27,

wherein the intermediate layer having a storage
elasticity modulus G' of 2×10^6 Pa or lower at 20°C and a
frequency of 5.0×10^1 to 1.0×10^2 Hz is biased to the
15 side of either surface layer with respect to the thickness
direction of the interlayer film for laminated glasses.

29. The laminated glass according to Claim 12,
wherein the interlayer film for laminated glasses has
20 a multilayer structure of four-layers or more and a storage
elasticity modulus G' at 20°C and a frequency of 5.0×10^1
to 1.0×10^2 Hz in one or any of two layers composing the
outermost layer is at or below a half of a storage
elasticity modulus G' at 20°C and a frequency of 5.0×10^1
25 to 1.0×10^2 Hz in at least one layer of an intermediate
layer.

30. The laminated glass according to Claim 29,
wherein a storage elasticity modulus G' at 20°C and a
30 frequency of 5.0×10^1 to 1.0×10^2 Hz in one or any of two
layers composing the outermost layer is 2×10^6 Pa or lower
and a storage elasticity modulus G' at 20°C and a frequency
of 5.0×10^1 to 1.0×10^2 Hz in at least one layer of the
intermediate layer is 1×10^7 Pa or higher.

31. The laminated glass according to Claim 30,
wherein $\tan \delta$ at 20°C and a frequency of 5.0×10^1 to
 1.0×10^2 Hz in one or any of two layers composing the
outermost layer is 0.7 or more.

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32. The laminated glass according to Claim 29, 30 or
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wherein a total thickness of the outermost layer is
10% or higher of a total thickness of the interlayer film
for laminated glasses.

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33. The laminated glass according to Claim 21, 22,
23, 30, 31 or 32,

wherein the intermediate layer having the storage
elasticity modulus G' of 1×10^7 Pa or higher at 20°C and a
frequency of 5.0×10^1 to 1.0×10^2 Hz is biased to the
side of either surface layer with respect to the thickness
direction of the interlayer film for laminated glasses.

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34. The laminated glass according to Claim 12, 16,
17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31,
32 or 33,

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wherein the interlayer film for laminated glasses has
a multilayer structure of three-layers or more and each
layer has wedged form and the layer having wedged form is
alternately overlaid with the layer of wedged form having a
small storage elasticity modulus G' taken as an
intermediate layer so that an overall thickness becomes
uniform.

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35. The laminated glass according to Claim 1 or 2,
wherein the interlayer film for laminated glasses
generates a break of 10 mm or longer in length in measuring
a Head Injury Criteria (HIC) value.

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36. The laminated glass according to Claim 1, 2 or 3, wherein the interlayer film for laminated glasses has a sandwiched structure between glass sheets and a thickness of at least one glass sheet is 1.8 mm or smaller.

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37. The laminated glass according to Claim 1, 2 or 3, wherein the interlayer film for laminated glasses is sandwiched between a glass sheet and a transparent resin plate.

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38. The laminated glass according to Claim 37, wherein the transparent resin plate comprises polycarbonate, acrylic resin, acrylic copolymerizable resin or polyester resin.

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39. The laminated glass according to Claim 37 or 38, wherein the transparent resin plate is coated with transparent elastomer.

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40. The laminated glass according to Claim 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38 or 39,

wherein electromagnetic wave shielding performance in frequencies of 0.1 to 26.5 GHz is 10 dB or less, haze is 1% or lower, visible transmittance is 70% or higher, and solar radiation transmittance in a wavelength region of 300 to 2,100 nm is 85% or lower of visible transmittance.

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41. An interlayer film for laminated glasses, which contains a plasticizer for interlayer films in an amount 30 parts by weight or more per 100 parts by weight of polyvinyl acetal resin,

a storage elasticity modulus G' in a linear dynamic viscoelasticity test, measured with frequencies being

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varied at 20°C in a range of frequencies of 5.0×10^1 to 1.0×10^2 Hz, is 3×10^7 Pa or lower.

42. The interlayer film for laminated glasses
5 according to Claim 41,
wherein $\tan \delta$ of at least one point is 0.6 or more at 20°C in a range of frequencies of 5.0×10^1 to 1.0×10^2 Hz.

43. The interlayer film for laminated glasses
10 according to Claim 41 or 42,
wherein maximum stress σ is 20 MPa or smaller and fracture point deformation ϵ is 200% or more, derived from a stress-deformation curve at 20°C and a tensile speed of 500%/min.

15 44. The interlayer film for laminated glasses
according to Claim 43,
wherein breaking energy is 1.0 J/mm^2 or larger.

20 45. The interlayer film for laminated glasses
according to Claim 41, 42, 43 or 44,
which comprises a crosslinked polyvinyl acetal resin having an acetalization degree of 60 to 85 mol% and contains a plasticizer for interlayer films in an amount
25 40 parts by weight or more per 100 parts by weight of the
above-mentioned polyvinyl acetal resin.

46. The interlayer film for laminated glasses
according to Claim 45,
30 which has a thickness of 800 μm or more.

47. The interlayer film for laminated glasses
according to Claim 41, 42, 43, 44, 45 or 46,
which comprises a polyvinyl acetal resin, a half band
35 width of a peak of a hydroxyl group in measuring infrared

absorption spectra being 250 cm^{-1} or less.

48. The interlayer film for laminated glasses according to Claim 41, 42, 43, 44, 45, 46 or 47,
5 wherein rubber particles are dispersed.

49. The interlayer film for laminated glasses according to Claim 41, 42, 43, 44, 45, 46, 47, or 48,
10 which has a multilayer structure.

50. The interlayer film for laminated glasses according to Claim 49,
which has a two-layers structure, a storage
elasticity modulus G' at 20°C and a frequency of 5.0×10^1
15 to 1.0×10^2 Hz in one layer being at or below a half of a
storage elasticity modulus G' at 20°C and a frequency of
 5.0×10^1 to 1.0×10^2 Hz in the other layer.

51. The interlayer film for laminated glasses
20 according to Claim 50,
wherein a storage elasticity modulus G' at 20°C and a
frequency of 5.0×10^1 to 1.0×10^2 Hz in one layer is $2 \times$
 10^6 Pa or lower and a storage elasticity modulus G' at 20°C
and a frequency of 5.0×10^1 to 1.0×10^2 Hz in the other
25 layer is 1×10^7 Pa or higher.

52. The interlayer film for laminated glasses according to Claim 51,
wherein the layer having a storage elasticity modulus
30 G' of 5.0×10^1 to 1.0×10^2 Hz of 2×10^6 Pa or lower at
 20°C and a frequency has $\tan \delta$ of 0.7 or more at 20°C and a
frequency of 5.0×10^1 to 1.0×10^2 Hz.

53. The interlayer film for laminated glasses
35 according to Claim 49,

which has a three-layers structure, a storage elasticity modulus G' at 20°C and a frequency of 5.0×10^1 to 1.0×10^2 Hz in an intermediate layer being at or below a half of a storage elasticity modulus G' at 20°C and a
5 frequency of 5.0×10^1 to 1.0×10^2 Hz in one or any of two layers composing the outermost layer.

54. The interlayer film for laminated glasses according to Claim 53,
10 wherein a storage elasticity modulus G' at 20°C and a frequency of 5.0×10^1 to 1.0×10^2 Hz in the intermediate layer is 2×10^6 Pa or lower and a storage elasticity modulus G' at 20°C and a frequency of 5.0×10^1 to 1.0×10^2 Hz in one or any of two layers composing the outermost
15 layer is 1×10^7 Pa or higher.

55. The interlayer film for laminated glasses according to Claim 54,
wherein the intermediate layer has $\tan \delta$ of 0.7 or
20 more at 20°C and a frequency of 5.0×10^1 to 1.0×10^2 Hz.

56. The interlayer film for laminated glasses according to Claim 53, 54 or 55,
wherein a thickness of the intermediate layer is 10%
25 or higher of a total thickness of the interlayer film for laminated glasses.

57. The interlayer film for laminated glasses according to Claim 49,
30 which has a three-layers structure, a storage elasticity modulus G' at 20°C and a frequency of 5.0×10^1 to 1.0×10^2 Hz in one or any of two layers composing the outermost layer being at or below a half of a storage elasticity modulus G' at 20°C and a frequency of 5.0×10^1
35 to 1.0×10^2 Hz in an intermediate layer.

58. The interlayer film for laminated glasses according to Claim 57,

5 wherein a storage elasticity modulus G' at 20°C and a frequency of 5.0×10^1 to 1.0×10^2 Hz in one or any of two layers composing the outermost layer is 2×10^6 Pa or lower and a storage elasticity modulus G' at 20°C and a frequency of 5.0×10^1 to 1.0×10^2 Hz in the intermediate layer is 1×10^7 Pa or higher.

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59. The interlayer film for laminated glasses according to Claim 58,

15 wherein $\tan \delta$ at 20°C and a frequency of 5.0×10^1 to 1.0×10^2 Hz in one or any of two layers composing the outermost layer is 0.7 or more.

60. The interlayer film for laminated glasses according to Claim 57, 58 or 59,

20 wherein a total thickness of the outermost layer is 10% or higher of a total thickness of the interlayer film for laminated glasses.

61. The interlayer film for laminated glasses according to Claim 49,

25 which has a multilayer structure of four-layers or more, a storage elasticity modulus G' at 20°C and a frequency of 5.0×10^1 to 1.0×10^2 Hz in at least one layer of an intermediate layer being at or below a half of a storage elasticity modulus G' at 20°C and a frequency of
30 5.0×10^1 to 1.0×10^2 Hz in one or any of two layers composing the outermost layer.

62. The interlayer film for laminated glasses according to Claim 61,

35 wherein a storage elasticity modulus G' at 20°C and a

frequency of 5.0×10^1 to 1.0×10^2 Hz in at least one layer of the intermediate layer is 2×10^6 Pa or lower and a storage elasticity modulus G' at 20°C and a frequency of 5.0×10^1 to 1.0×10^2 Hz in one or any of two layers
5 composing the outermost layer is 1×10^7 Pa or higher.

63. The interlayer film for laminated glasses according to Claim 62,

wherein the intermediate layer having a storage
10 elasticity modulus G' of 2×10^6 Pa or lower at 20°C and a frequency of 5.0×10^1 to 1.0×10^2 Hz has $\tan \delta$ of 0.7 or more at 20°C and a frequency of 5.0×10^1 to 1.0×10^2 Hz.

64. The interlayer film for laminated glasses
15 according to Claim 62 or 63,

wherein a total thickness of the intermediate layer having a storage elasticity modulus G' of 2×10^6 Pa or lower at 20°C and a frequency of 5.0×10^1 to 1.0×10^2 Hz is 10% or higher of a total thickness of the interlayer
20 film for laminated glasses.

65. The interlayer film for laminated glasses according to Claim 54, 55, 56, 62, 63 or 64,

wherein the intermediate layer having the storage
25 elasticity modulus G' of 2×10^6 Pa or lower at 20°C and a frequency of 5.0×10^1 to 1.0×10^2 Hz is biased to the side of either surface layer with respect to the thickness direction of the interlayer film for laminated glasses.

30 66. The interlayer film for laminated glasses according to Claim 49,

which has a multilayer structure of four-layers or more, a storage elasticity modulus G' at 20°C and a frequency of 5.0×10^1 to 1.0×10^2 Hz in one or any of two
35 layers composing the outermost layer being at or below a

half of a storage elasticity modulus G' at 20°C and a frequency of 5.0×10^1 to 1.0×10^2 Hz in at least one layer of an intermediate layer.

5 67. The interlayer film for laminated glasses according to Claim 66,

 wherein a storage elasticity modulus G' at 20°C and a frequency of 5.0×10^1 to 1.0×10^2 Hz in one or any of two layers composing the outermost layer is 2×10^6 Pa or lower
10 and a storage elasticity modulus G' at 20°C and a frequency of 5.0×10^1 to 1.0×10^2 Hz in at least one layer of the intermediate layer is 1×10^7 Pa or higher.

 68. The interlayer film for laminated glasses
15 according to Claim 67,

 wherein $\tan \delta$ at 20°C and a frequency of 5.0×10^1 to 1.0×10^2 Hz in one or any of two layers composing the outermost layer is 0.7 or more.

20 69. The interlayer film for laminated glasses according to Claim 66, 67 or 68,

 wherein a total thickness of the outermost layer is 10% or higher of a total thickness of the interlayer film for laminated glasses.

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 70. The interlayer film for laminated glasses according to Claim 58, 59, 60, 67, 68 or 69,

 wherein the intermediate layer having the storage elasticity modulus G' of 1×10^7 Pa or higher at 20°C and a
30 frequency of 5.0×10^1 to 1.0×10^2 Hz is biased to the side of either surface layer with respect to the thickness direction of the interlayer film for laminated glasses.

 71. The interlayer film for laminated glasses
35 according to Claim 49, 53, 54, 55, 56, 57, 58, 59, 60, 61,

62, 63, 64, 65, 66, 67, 68, 69 or 70,

which has a multilayer structure of three-layers or more, each layer having wedged form and the layer having wedged form being alternately overlaid with the layer of
5 wedged having a small storage elasticity modulus G' taken as an intermediate layer so that an overall thickness becomes uniform.

72. An interlayer film for laminated glasses,
10 wherein a break of 10 mm or longer in length is generated when an laminated glass is formed by sandwiching the interlayer film for laminated glasses between two glasses and a Head Injury Criteria (HIC) value of the laminated glass is measured.

15 73. The interlayer film for laminated glasses according to Claim 41, 42, 43, 44, 45, 46, 47 or 48, wherein polyvinyl acetal resin contains metal oxide particles having a function of screening out heat rays.

20 74. The interlayer film for laminated glasses according to Claim 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71 or 72, wherein polyvinyl acetal resin of at least one layer
25 contains metal oxide particles having a function of screening out heat rays.

75. The interlayer film for laminated glasses according to Claim 73 or 74,
30 wherein the particle of metal oxide is tin-doped indium oxide and/or antimony-doped tin oxide, and the above-mentioned tin-doped indium oxide and/or the above-mentioned antimony-doped tin oxide has an average diameter of secondary particles formed by flocculation of 80 nm or
35 smaller and is dispersed in polyvinyl acetal resin in such

a way that a secondary particle formed by flocculation of 100 nm or larger in diameter has a density of 1 particle/ μm^2 or less in polyvinyl acetal resin.